

December 2019

Round 2 is a very different kind of paper and contains a variety of question styles. The ability to come up with ideas and explanations is important, along with some rather harder calculations, not in mathematical content but in how to convert the question into a mathematical form that can be manipulated or solved. **You must work through some past Round 2 questions.** They may find these very difficult. They really are. They are developing perseverance and fortitude. They should also work through “*Upgrade Your Physics*”, downloadable from the BPhO website, <http://www.physics.ox.ac.uk/olympiad/PastForStudents.html>

The topics included go beyond current A level syllabi, but you will not be expected to have expert knowledge in more technical aspects of Gauss’s Theorem, electromagnetism, Relativity, etc.; you will be expected to be given some starting points and work from there. You should be familiar with some of the material in the following in order to recognise the context of a question. Introductory material is provided in a question where appropriate, but if you have never come across it at all before then you will find it harder.

- [Upgrade Your Physics 1 - Linear Mechanics](#)
  - 1.1 Motion on a Line
  - 1.2 Going Orbital
  - 1.3 Fluids - When Things Get Sticky
  - 1.4 Questions
- [Upgrade Your Physics 2 - Fast Physics](#)
  - 2.1 The Principle of Relativity
  - 2.2 High Speed Observations
  - 2.3 Relativistic Quantities

Whilst questions involving Relativity can appear, they are not at the level of university, in which they are expected to solve one of the paradox types of question, or at a high level mathematical approach. They may be asked about the effect as the speed approaches that of light,  $\gamma$  factor,  $E = mc^2$ ,  $p = \gamma mv$ ,  $E^2 = p^2c^2 + m_0^2c^4$ , etc.

- [Upgrade Your Physics 3 - Rotation](#)
  - 3.1 Angle
  - 3.2 Angular Velocity
  - 3.3 Angular Acceleration
  - 3.4 Torque - Angular Force
  - 3.6 Angular Momentum
  - 3.7 Angular Momentum of a single mass moving in a straight line
  - 3.8 Rotational Kinetic Energy
  - 3.9 Summary of Quantities
  - 3.13 Questions
- [Upgrade Your Physics 4 - Vibes, Wiggles and Light](#)
  - 4.1 Oscillation
  - 4.2 Waves and Interference
  - 4.3 Rays
  - 4.4 Fermat’s Principle
  - 4.5 Questions
- [Upgrade Your Physics 5 - Hot Physics](#)
  - 5.1 The Conservation Of Energy
  - 5.6 Re-Statement Of First Law

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The BPhO Office, Clarendon Lab, Department of Physics, University of Oxford, Oxford, OX1 3PU;  
01865 272884; [bpho@physics.ox.ac.uk](mailto:bpho@physics.ox.ac.uk)

- 5.7 The Boltzmann Law
- 5.8 Perfect Gases
- 5.9 Radiation Of Heat
- 5.10 Questions
- [Upgrade Your Physics 6 - Sparks and Generation](#)
  - 6.1 Electrostatics – When Things Are Still (But not Gauss’s Law mathematically)
  - 6.2 Magnetism – When Things Move (But not the Ampere Law)
  - 6.3 Circuits – Putting It Together
  - 6.4 Questions
- [Upgrade Your Physics 7 - Small Physics](#)
  - 7.1 Waves And Particles
  - 7.2 Uncertainty
  - 7.3 Atoms
  - 7.4 Little Nuts
  - 7.5 Questions
- [Upgrade Your Physics 8 - Practical Physics](#)
  - 8.1 Errors, And How To Make Them
  - 8.2 Errors, And How To Make Them Worse
  - 8.3 Systematic Errors
  - 8.4 Which Graph?
  - 8.5 Questions
- [Upgrade Your Physics 9 - Appendix](#)
  - 9.1 Multiplying Vectors
  - 9.2 Dimensional Analysis

Much of this you will have met before, but they need to know that material well and be a little more sophisticated in its application in problems.

Students are welcome to email Robin Hughes on [rh584@cam.ac.uk](mailto:rh584@cam.ac.uk) to ask questions.